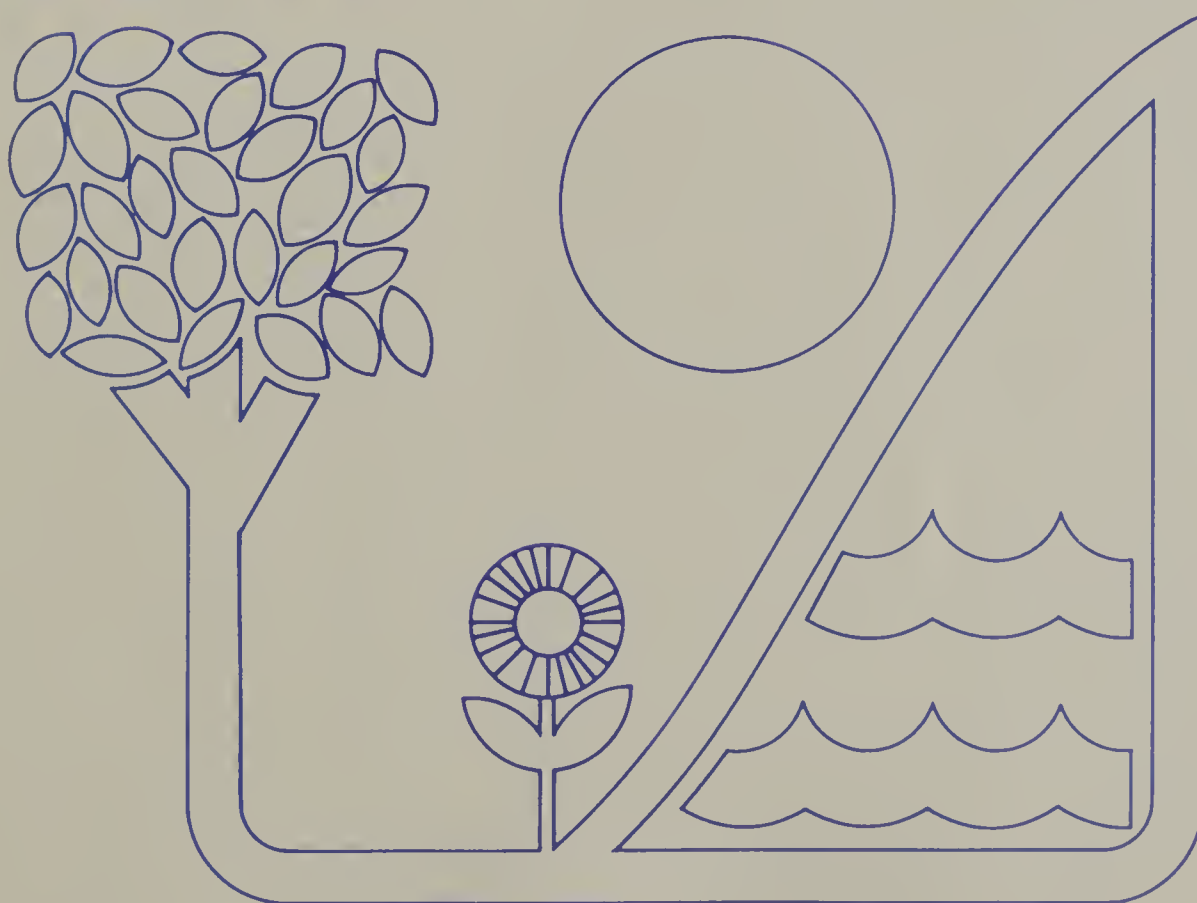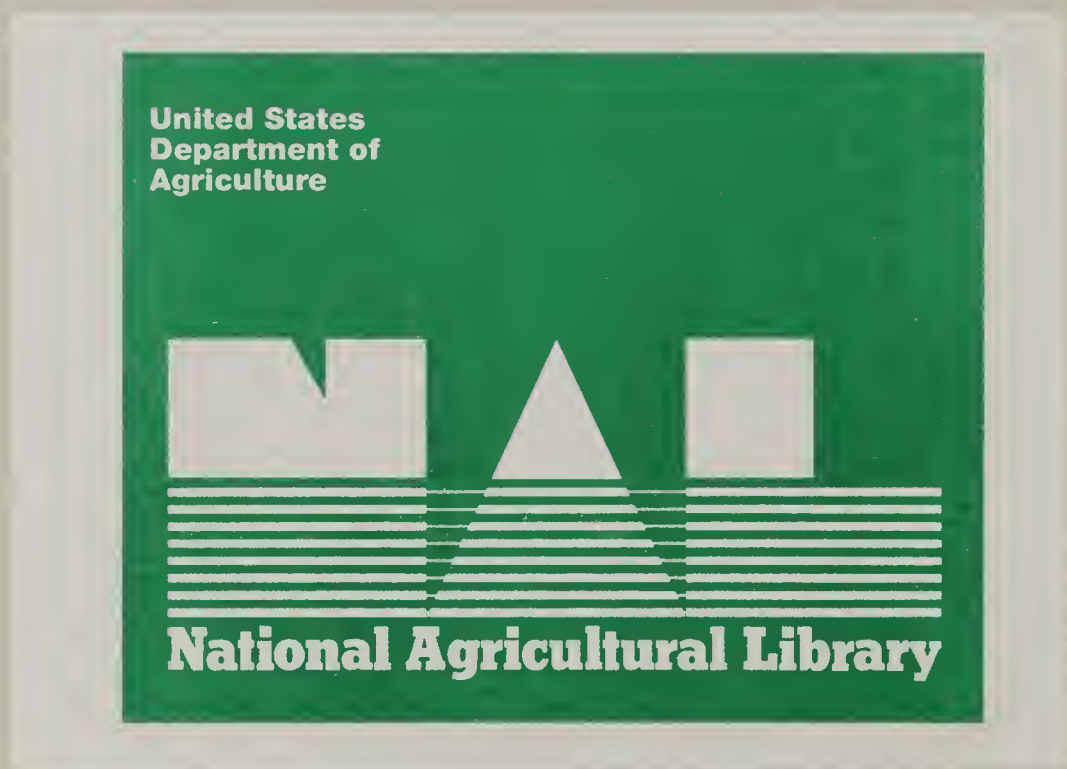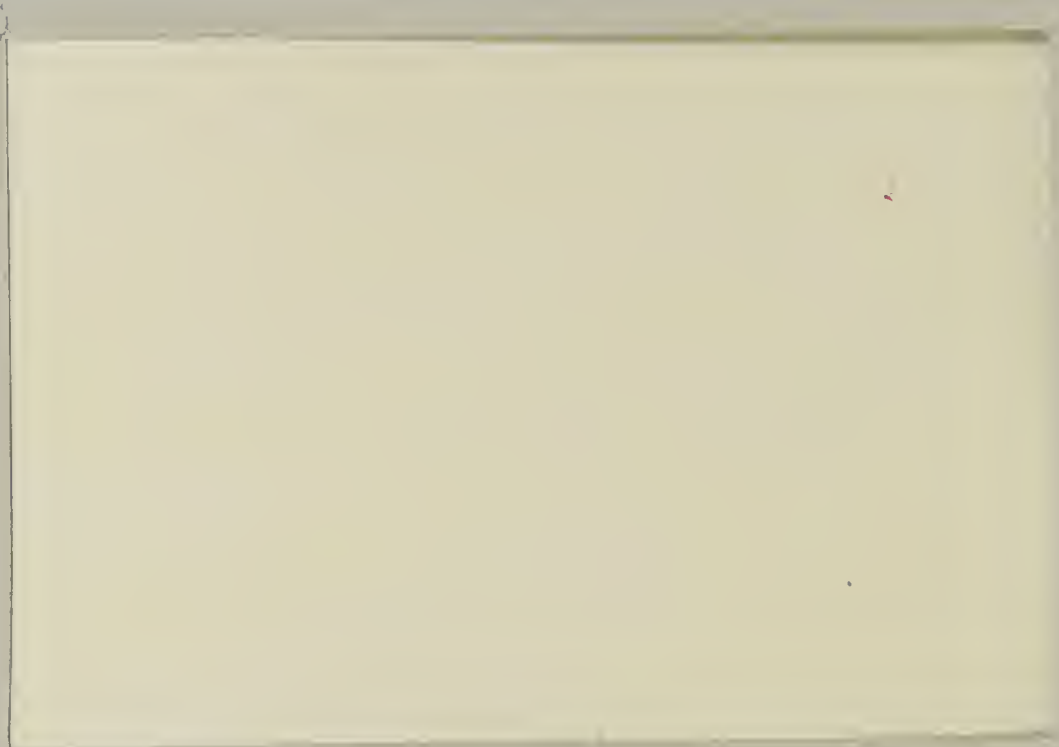# STAFF REPORT

NRE Economic Research Service

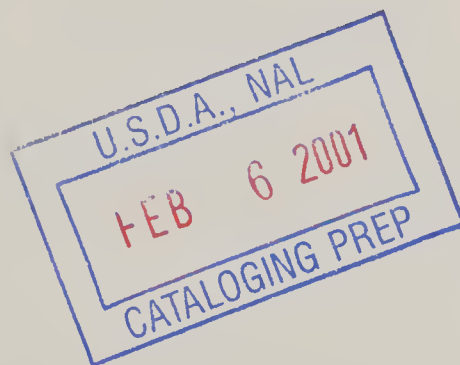United States Department of Agriculture

LANDOWNERSHIP CHARACTERISTICS AND

INVESTMENT IN SOIL CONSERVATION

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ABSTRACT

Logit regression analyses of 1978 Resource Economic Survey data are performed
to determine factors distinguishing farmland owners who invested in soil con-
servation practices from owners who did not invest. In most areas studied,
owners who operated their land or who used share leases on land rented out
were more likely to have invested than owners who rented out all land using
only cash leases. The need for policies to encourage greater investment is
suggested by evidence of trends toward increase in the percentage of all
farmland that is owned by nonoperators and in the percentage of rental land
that is farmed under cash leases.

Key words: Conservation investment; land ownership; leasing; soil erosion;
            tenure.

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ACKNOWLEDGEMENTS

CONTENTS

1. Introduction

During the last thirty years, ownership of U.S. farmland by nonfarm operators has been increasing relative to ownership by operators. In 1946, the Inman and Fippin Survey estimated that nonoperator farmland owners held 22 percent of all U.S. farm acreage (10).[1] The 1978 Resource Economic Survey estimated that as of January 1, 1978, nonoperator owners held 28 percent of all U.S. farm acreage (15).

Leasing practices in the United States have also been changing during the past 30 years. The U.S. Census of Agriculture estimated that in 1950, 15 percent of all full-time tenant farm operators in the United States used cash rental leases while 74 percent used some form of share rental lease; in 1974, 27 percent of all full-time tenant operators used cash rental leases, while only 50 percent used share leases (19).[2]

These operatorship and leasing trends have raised concern about the level of landlord contribution to farm financing and operation. Some observers argue that since nonoperator landlords generally have much less knowledge and concern about farming than do operator owners, they also contribute less to the financing of investment in long-term capital improvements (5, 6). Much more than owner operators, they are likely to be interested in extracting the highest possible short-term gain from their land at the lowest risk possible and at the expense of long-term gain (1). On the other hand, those nonoperators who do wish to assist tenants in financing farm improvement projects are often discouraged by the time and effort required to negotiate the distribution of costs and benefits (2, 8, 12).

Other observers emphasize the distinction between cash and share rental leases. The former pay landlords a contractually stipulated cash payment,

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[1] Underscored numbers in parenthesis refer to references listed at the end of this report.

while the latter set rent equal to a fraction of total farm income.
Share rental landlords, unlike cash rental landlords assume part of the
risk of year-to-year variations in farm income. Some observers argue
that the former therefore have a greater incentive than the latter to
assist tenants through financing of investments in farm improvements
(16, 18).

Little evidence of relative operator-nonoperator or relative share
rental landlord-cash rental landlord contribution to farm investment
has been produced. A few studies have examined the attitudes of non-
operator landlords toward the need for investment in soil conservation
practices (4, 9). No determinations have been made, however, of whether
these landlords invest as frequently or commit as much funds as do owner
operators, or whether those nonoperators who use cash leases invest as
much as those who use share leases.

This paper provides partial answers to these questions. The paper
analyzes 1978 Resource Economic Survey (RES) data obtained from questionnaire
responses provided by a sample of 6,968 U.S. farmland owners. These owners
held land located in an area in the Central United States encompassed by
the Cornbelt, Delta, Southern Plains and Northern Plains Farm Production
Regions. In this paper, the boundaries of the Regions, shown in Figure 1,
approximate the boundaries of the Farm Production Regions defined in the
RES (11, p. 36). In Figure 1, southern Missouri and western Tennessee and
Kentucky are added to the Delta Region, defined in the RES to include all
of Arkansas, Louisiana and Mississippi. Southern Michigan, Minnesota and
Wisconsin are added to and eastern Ohio and southern Missouri are deleted
from the Cornbelt Region, defined in the RES to include all of Ohio, Indiana,
Illinois, Iowa and Missouri.

Owners in the RES sample were asked whether or not they invested in soil
conservation practices, such as terraces, grass waterways, or gully control,

during the three year period 1975 to 1977. Usable data on the dollar

amount of the investments are not yet available, so this paper analyzes

only the "yes-no" responses to the conservation question. The paper em-

ploys a logit regression model to identify factors distinguishing owners

who invested in conservation from those who did not. A number of hypotheses

concerning the ownership characteristics of investors and noninvestors are

tested. Two in particular are given special consideration. The first is

that owners who operate part or all of their farmland are more likely to

invest in soil conservation than are owners who rent out all of their

farmland. The second is that landlords who use share rental leases are

more likely to invest in conservation than are landlords who use cash

rental leases.

In the next section, the method used by the RES to select the sample

owners is reviewed. Section 3 explains the process of estimating a logistic

curve that relates owner investment in conservation to ownership characteristics.

These characteristics include, in addition to operatorship and lease type,

the amount and value of the farmland owned, the owner's age and level of

education, and the owner's net farm income in 1977. Sections 4, 5 and 6 of

the paper examine the implications of the regression analysis in light of

evidence of past ownership trends and likely future developments. Section

7 considers policy alternatives.

(2) The Resource Economic Survey (RES)

The RES is an extension of earlier surveys conducted by the Soil

Conservation Service (SCS) to obtain an inventory of land quality (11).

This inventory, now known as the 1977 National Resource Inventory (NRI)

included every county in the nation. Each county was stratified into

blocks of land, generally 160 acres in size. Seventy thousand of these

blocks, known as primary sampling units (PSU), were selected for data

collection. Land quality data, such as soil erosion levels, land use, and

current land management practices were provided for three randomly selected

points within each PSU (11). SCS provided the U.S. Department of Agriculture's

Natural Resource Economics Division (NRED) the name and address of the owner

of the land encompassing one of the three points.

Approximately 57,000 points fell on privately owned land, while

12,000 were located on Government owned land, or land held in trust for

Indian tribes. Names and addresses were obtained for owners of 52,000 of the

57,000 points. Each owner received a questionnaire designed to obtain in-

formation on all land owned within the county listed in the questionnaire's

address label (11).

Of the 37,333 questionaires that were returned and determined to be

usable, a subsample of 26,209 indicated ownership of farmland, defined

as cropland, pasture, woodland, wasteland and farmsteads. As mentioned

earlier, 6,968 of these owners lived within the area covered by the Cornbelt,

Delta, Southern Plains, and Northern Plains Farm Production Regions. A

comparison of the map of these Regions, shown in Figure 1, with the SCS

soil erosion map shown in Figure 2 indicates why these four Regions were

chosen for analysis. Each dot in Figure 2 equals 250,000 tons of soil lost

annually through sheet and rill erosion. The four Farm Production Regions

therefore encompass an area where investment in soil conservation is likely

to be essential to the maintenance of soil productivity. The focus of the

regression analysis that follows is the set of questionnaire responses in-

dicating whether each of the owners from these Regions invested in soil

conservation on the farmland he or she owned in the county selected by

the RES sample.

Figure 1. Farm Production Regions of the Central United States

A-Southern Plains
B-Delta
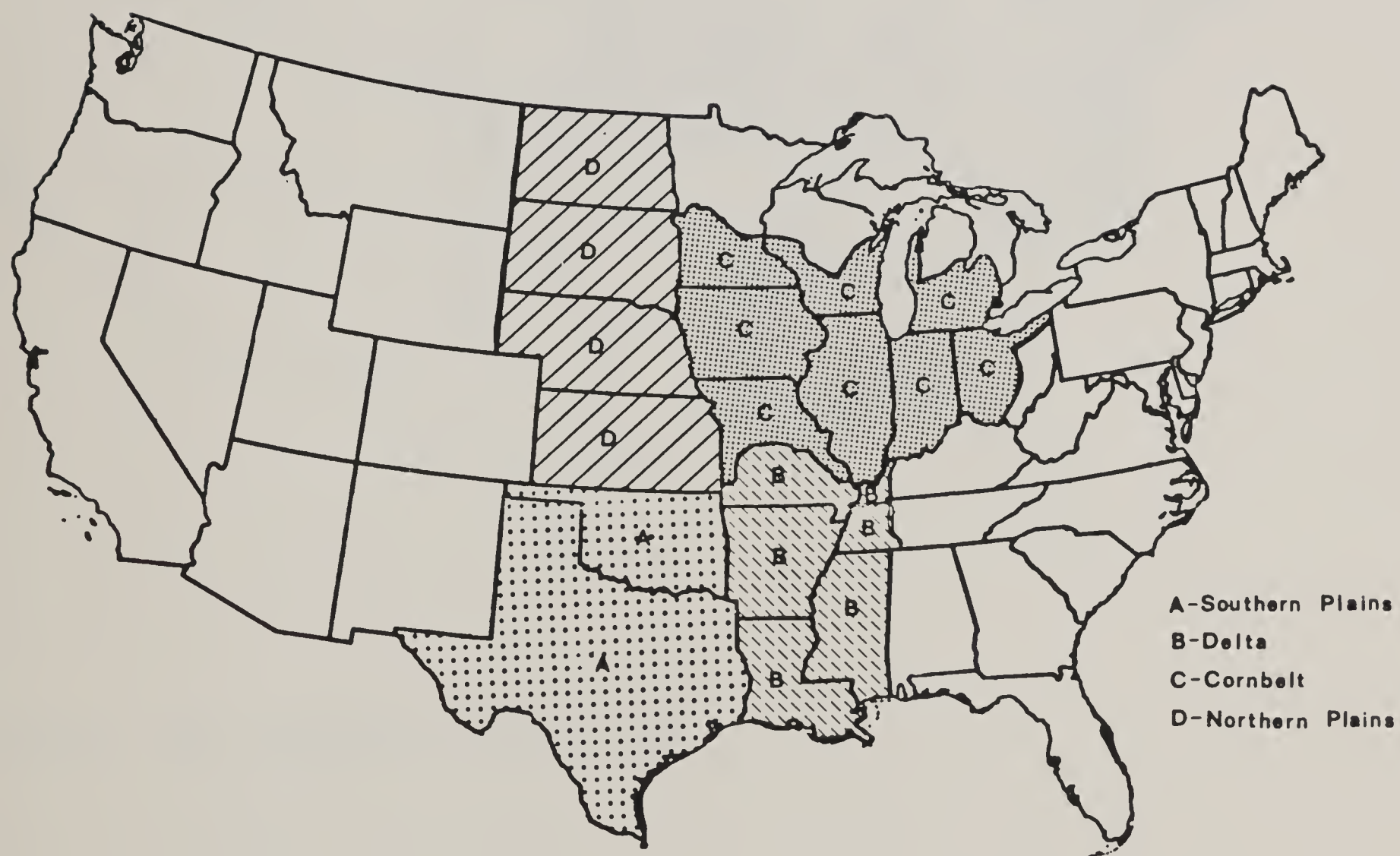C-Cornbelt
D-Northern Plains

Figure 2--Total tons of cropland sheet and rill erosion: 1977. One dot
equals 250,000 tons of soil eroded annually; total annual soil loss
equals 2 billion tons. Most serious sheet and rill erosion occurs in
the Cornbelt and Delta States and West Tennessee.

Source: Soil Conservation Service, USDA.

(3) The Logit Model

This paper employs a logit regression model that relates the predicted probability of investment by a farmland owner to various ownership characteristics. The relationship is expressed in the equation:

(1) $\quad P = \dfrac{1}{1 + \exp(-\Theta\, x)}$, where

$$X = \Theta_0 + \Theta_1\, share + \Theta_2\, part + \Theta_3\, partshare + \Theta_4\, fullop + \Theta_5\, acreage + \Theta_6\, value + \Theta_7\, age + \Theta_8\, education + \Theta_9\, net\ farm\ income.$$

The first four independent variables, "share," "part," "partshare," and "fullop" are dummies representing different combinations of tenure and lease type.[3/] Each owner falls into one of five categories. He or she is either:

(1) a landlord who rents out all owned land using only cash rental leases (hereafter referred to as a full-time cash rental landlord).

(2) a landlord who rents out all owned land and uses share rental leases on at least part of that land (hereafter referred to as a full-time share rental landlord).

(3) a landlord who operates some owned land and uses only cash leases on land rented out (hereafter referred to as a part-time operator cash rental landlord).

(4) a part-time operator landlord who uses share leases on at least part of the land rented out (hereafter referred to as a part-time operator share rental landlord).

(5) a full-time operator.

If the owner is a full-time cash rental landlord, all four dummy variables

in equation 1 equal 0. If the owner is a full-time share rental landlord, "share" equals 1 and the other three dummies equal 0. If the owner is a part-time operator cash rental landlord, only "part" equals 1, while the other three dummies equal 0. If the owner is a part-time operator share rental landlord, "share," "part" and "partshare" equal 1, while "fullop" equals 0. Finally, if the owner is a full-time operator, only "fullop" equals 1, with all other dummies equaling 0.

Of the remaining variables in equation 1, "acreage" is the total amount of farmland owned by the respondent and "value" is the value per acre of that land. "Education" is the number of years of school completed, with values ranging from 6 for the owner with a 6th grade education or less, to 18 for the owner with 18 or more years of education. "Net farm income" is gross farm income in 1977 minus operating expenses and depreciation. Responses to the farm income question were limited to the categories of income reported in (11).$^{4/}$

What are the likely values of the coefficients for each of the independent variables in equation 1? Since the linear portion-- ΘX --of the equation is the negative exponent of the exponential function, a statistically significant positive (negative) regression coefficient will indicate that probability of investment is positively (negatively) correlated with the independent variable.

As mentioned in the Introduction, some observers have hypothesized that farmland owners who operate at least part of their own farmland are more likely to invest in soil conservation than are nonoperator owners. This hypothesis will be confirmed if the estimated coefficients for "part" and "fullop" in equation 1 are significantly greater than 0.

Other observers have hypothesized that full-time share rental landlords are more likely to invest than full-time cash rental landlords. This will be confirmed if the estimated coefficient for "share" in equation 1 is significantly greater than 0 .

The value of the coefficient for "partshare" is more difficult to predict. If the effect of simultaneous changes from full-time nonoperator to part-time operator status and from cash to share rental leasing is expected to equal the sum of the coefficients for "share" and "part," then "partshare" should equal 0 . It seems more likely, however, that this sum would overstate the true effect of such simultaneous changes, in which case the coefficient for "partshare" should be negative.

Farmland acreage and value per acre are measures of the ability of the farmland owner to finance conservation investment through borrowing. The greater the acreage owned, and the greater the value per acre of that land, the greater is the borrowing leverage. Since one can expect actual investment to be positively correlated with ability to finance investment, the coefficients of both "acreage" and "value" in equation 1 should be positive. The acreage coefficient in particular can be expected to have a positive value for the additional reason that the greater the acreage owned, the greater the likelihood of investment on any portion of the total landholdings. The ability of an owner to finance investment is also positively related to the owner's income. The coefficient for "net farm income" in equation 1 should therefore have a positive value as well.

The coefficient for "age" in equation 1 on the other hand can be expected to have a negative value. Older farmland owners typically have shorter planning horizons than younger owners and may therefore be less interested than the latter in long-term efforts to maintain soil productivity.

The coefficient for "education" in equation 1 is more difficult to predict. Perhaps a very tentative argument could be made that the coefficient should be positive on grounds that the more educated the owner, the greater is the likelihood that he or she will recognize the potential for loss of soil productivity from erosion and be aware of alternative soil conservation practices.

The regression coefficients in equation 1 are estimated through application of a nonlinear maximum likelihood algorithm provided by the SAS statistical package (7). Separate sets of coefficients are estimated for the Cornbelt, Delta, Southern Plains and Northern Plains Regions. The following sections present the results for each Region.

(a.) The Southern Plains:

The estimated regression equation for this Region indicates a strong positive relationship between tenure of owner and probability of investment in soil conservation, and between lease type and probability of investment. From 1353 questionaire responses, the following was estimated;

(2.) $\theta X = -1.00 + .75$ share $+ 1.27$ part $- .38$ partshare $+ 1.25$ fullop $+$
        (.037) (.012)   (.001)   (.233)   (.000)

     $.00003$ acreage $+ .00007$ value $- .03$ age $+ .02$ education $+$
     (.004)   (.140)   (.000)   (.156)

     $.000006$ net farm income.
     (.069)

Probability values for each coefficient, derived from the standard normal distribution are listed in the parentheses.[5] They indicate that the coefficients for share, part, fullop, acreage and age are all significant at the 2.5 percent level or less. The coefficient for net farm income is significant at the 10 percent level.

The exact relationship between the vector of sample coefficients and predicted probability of investment is shown in Table 1. The last column of each row in the Table lists the probability associated with a given set of assumed values for the independent variables. In the first 5 rows, all variables other than the dummies are assigned their average sample values for the Southern Plains Region. In 1977, the average Southern Plains farm-land owner in the sample of 1353 owners was a 57 year old high school graduate who earned a net farm income of $6,630 and owned 2,336 acres of farmland worth $493 per acre. Row 1 futher assumes the owner is a full-time cash rental landlord (all 4 dummies equal 0). The estimated probability of investment of 11.1 percent, indicated in the last column, is calculated by substituting the estimated sample coefficients - shown at the top of the table - and the corresponding dummy and sample average values, shown in row 1, into equation 1. This 11.1 percent probability indicates that approximately 11 out of 100 full-time cash rental landlords in the Southern Plains Region are predicted to have reported investment in conservation during the period 1975 to 1977.

Row 2 shows the effect of change from full-time cash to full-time share rental status. The predicted probability of investment increases from 11.1 to 20.9 percent, reflecting the coefficient .75 in equation 2.

Row 3 shows the effect of change to part-time operator cash rental status. The increase in probability of investment from 11.1 to 30.8 percent reflects the coefficient of 1.27 in equation 2.

Row 4 shows the effect of change to part-time operator share rental status. Probability of investment increases to 39.2 percent.

Row 5 shows the effect of change to full-time operator status, and shows a new predicted probability of investment of 30.3 percent.

Table 1--Probability of Investment in Soil
Conservation, The Southern Plains

Tenure and type of lease	Independent variable									Probability of Investment
	share	part	part share	fullop	aceage	value	age	education	net farm income	
	.75	1.27	-.38	1.25	.00003	.00007	-.03	.02	.000006	
1. full-time cash rental	0	0	0	0	2,336	493	57	13	6,630	11.1
2. full-time share rental landlord	1	0	0	0	2,336	493	57	13	6,630	20.9
3. part-time operator cash rental landlord	0	1	0	0	2,336	493	57	13	6,630	30.8
4. part-time operator share rental landlord	1	1	1	0	2,336	493	57	13	6,630	39.2
5. full-time operator	0	0	0	1	2,336	493	57	13	6,630	30.3
6. part-time operator share rental landlord	1	1	1	0	2,536	493	37	13	11,630	46.4
7. full-time cash rental landlord	0	0	0	0	2,536	693	57	13	6,630	11.3
8. full-time cash rental landlord	0	0	0	0	2,336	493	57	13	11,630	11.4

Equation 2 and Table 1 strongly support the hypothesis that probability of investment is higher for operators than for nonoperators, and higher for share rental landlords than for cash rental landlords. The regression results further show that change in tenure has a greater effect on probability of investment than change in lease type. In equation 2, the coefficient 1.27, which measures the effect of change from full-time cash rental landlord status to part-time operator cash rental status in the Southern Plains exceeds the coefficient .75, which measures the effect of change from full-time cash rental to full-time share rental status in that Region. The difference equals the coefficient .52. To test this coefficient, a probability value of .085 was calculated, indicating significance at the 10 percent level. The coefficient measures the net positive effect of change from full-time share rental to part-time operator cash rental status. This effect is shown in Table 1 as the increase in predicted probability of investment from 20.9 percent in row 2 to 30.8 percent in row 3.

Two other results concerning tenure and lease type should be noted. First, the probability of investment by part-time cash rental landlords is virtually equal to the probability of investment by full-time owner operators. Apparently, once an owner operates a fraction of his own land, further increases in the percentage operated will have no additional positive effect on probability of investment beyond the effect produced by the initial change from nonoperator status.

Equation 2 and Table 1 also show that change from cash to share leasing has only a slight positive effect on probability of investment by the part-time operator landlord. The effect is measured by the difference between the coefficient for the part-time operator share rental landlord, equal to 1.27 + .75 − .38, and the coefficient for the part-time operator cash rental landlord, equal to 1.27. This difference equals the coefficient .37, which

has a probability value of .174 indicating lack of statistical significance.
The implication is that the terms of the leasing contracts employed on land
rented out have much less impact on the part-time operator's decision to
invest or not to invest than they have on the full-time nonoperator land-
lord's decision.

Equation 2 also shows that the sample coefficients for farmland
acreage owned and age of the owner are significant at the 1 percent level,
while the coefficient for net farm income is significant at the 10 percent
level. Row 6 in Table 1 shows that the part-time operator share rental land-
lord who owns 200 acres of land more than the average owner, who earns $5,000
more per year in net farm income than the average owner, and who is 20 years
younger than average has a predicted probability of investment of 46.4 percent.
Thus, a change in ownership status from that of a 57 year old full-time cash
rental landlord owning 2,336 acres and earning $6,630 of net farm income per
year (row 1), to that of a 37 year old part-time operator share rental landlord
owning 2,536 acres and earning $11,630 per year (row 6) increases the pre-
dicted probability of investment by over 35 percentage points.

(b.) The Delta and Cornbelt Regions:

A sample of 772 questionaire responses from the Delta region produced the
following estimate:

(3) $\theta X =$ -3.18 + .99 share + 1.46.part − 1.06 partshare + .95 fullop +
        (.000)   (.029)   (.006)   (.067)   (.018)

.0004 acreage − .00009 value − .02 age + .13 education −
(.000)   (.352)   (.011)   (.000)

.000003 net farm income.
(.319)

The Cornbelt sample contained 2,279 responses and produced the following
estimate:

(4) Θ X = -2.29 + .89 share + 1.07 part - 1.07 partshare + .85 fullop +
     (.000)   (.000)   (.001)   (.007)   (.000)

   .001 acreage - .0001 value - .02 age + .08 education + 000005 net farm income
  (.000)   (.023)   (.000)   (.000)   (.111)

These estimates are quite similar to those in equation 2. The coefficients

for share, part and fullop are again statistically significant.

A list of estimated probabilities corresponding to different combinations

of independent variable values is provided in Tables 2 and 3. Rows 1 through 5

again assume average sample values for acreage owned, value, age, education

and net farm income. Row 1 in Table 2 indicates that the predicted probability

of investment by a full-time cash rental landlord is approximately 7.8 percent

in the Delta. Row 1, Table 3 indicates a probability of 10.1 percent in the

Cornbelt. A change to full-time share rental status increases the probability

to 18.6 percent in the Delta and 21.4 percent in the Cornbelt (Row 2, Tables

2 and 3). A change to part-time operator cash rental status and to part-time

operator share rental status increases the probability to 26.7 and 25.4 percent

in the Delta and to 24.6 and 21.4 percent in the Cornbelt (Rows 3 and 4, Tables

2 and 3.) A change to full-time operator status increases the probability to

18.0 percent in the Delta and 20.7 percent in the Cornbelt (Row 5).

Equations 3 and 4 also show that in both Regions, the effect of change in

tenure on predicted probability of investment appears greater than the effect

of change in lease type. The excess is not statistically significant, how-

ever. In equation 3, the coefficient 1.46, which measures the effect of

change from full-time cash rental to part-time operator cash rental status in

the Delta Region exceeds the coefficient .99, which measure the effect of

change from full-time cash rental to full-time share rental status in that

Region. This difference equals the coefficient .47, which has a probability

value of .169.

The coefficients 1.07 and .89 in equation 4 correspond to 1.46 and .99 in equation 3. The difference between 1.07 and .89, .18 has a probability value of .278. The excess of predicted probability of investment by part-time operator cash rental landlords (row 3, Tables 2 and 3) over predicted probability of investment by full-time share rental landlords (row 2, Tables 2 and 3) is therefore statistically insignificant in both the Delta and Cornbelt Regions.

The effect on probability of investment of change from part-time operator cash rental status to full-time operator status is negative in both the Delta and Cornbelt. In the Delta, this negative effect, measured by the difference between the coefficients .95 and 1.46 in equation 3 appears, somewhat surprisingly, to be quite strong. This difference of -.51 also has a probability value of only .100, indicating statistical significance at the 10 percent level. Such a result is especially perplexing because of the absence of any clear hypothesis of why a large difference between frequency of investment by part and full-time operators should exist.

The Cornbelt results have more intuitive appeal. Among Cornbelt landowners, the change from part-time operator cash rental to full-time operator status has only a small negative effect, measured by the difference between the coefficients .85 and 1.07 in equation 4. Moreover, this difference of -.22 has a probability value of .224, indicating lack of statistical significance.

Change from part-time operator cash rental to part-time operator share rental status has a statistically insignificant effect on probability of investment in both Regions, as is the case in the Southern Plains. In the Delta, this effect is actually negative, and is measured by the difference between the coefficient of 1.39 (equal to 1.46 + .99 - 1.06) for the part-time operator share rental landlord and the coefficient of 1.46 for the

part-time operator cash rental landlord. This difference of -.07 has a
very high probability value, .476. Among Cornbelt farmland owners, the
change from part-time operator cash rental to part-time operator share
rental status also has an insignificant negative effect measured by the
coefficient -.18 (equal to (1.07 + .89 - 1.07) - 1.07), which has a
probability value of .371.

Equations 3 and 4 also show that in the Delta, the education and farm
acreage coefficients are significant at the 1 percent level, while the age
coefficient is significant at the 2.5 percent level. In the Cornbelt, all
three of these coefficients are significant at the 1 percent level, while
the coefficient for value per acre is significant at the 2.5 percent level.
The latter coefficient is also negative, contrary to the hypothesis stated
earlier. A possible explanation is that serious erosion may have al-
ready reduced the income-producing potential of some Cornbelt landholdings,
resulting in lower land values. Owners of these landholdings have responded
by investing in conservation to a greater extent than have owners of land
that is less seriously eroded and therefore more valuable.

Row 6 in Table 2 shows that in the Delta, the part-time operator cash
rental landlord who owns 200 acres more than the average owner, who has 16
years of education (compared to the average of 12 years), and who is 35
years old (compared to the average of 55), has a predicted probability of
investment of 48.1 percent. Thus, change from full-time, 55 year old
high school educated, cash rental landlord status with 529 acres of land
owned (row 1), to college educated, part-time operator cash rental land-
lord status with 729 acres of land owned (row 6) increases predicted
probability of investment by over 40 percentage points.

Table 2--Probability of Investment in
Soil Conservation, The Delta

| Tenure and type of lease | Independent variable | | | | | | | | | Probability of Investment |
| | share | part | part share | fullop | acreage | value | age | education | net farm income | |
	.99	1.46	-1.06	.95	.0004	-.00009	-.02	.13	-.000003	
1. full-time cash rental landlord	0	0	0	0	529	638	55	12	9,060	7.8
2. full-time share rental landlord	1	0	0	0	529	638	55	12	9,060	18.6
3. part-time operator cash rental landlord	0	1	0	0	529	638	55	12	9,060	26.7
4. part-time operator share rental landlord	1	1	1	0	529	638	55	12	9,060	25.4
5. full-time operator	0	0	0	1	529	638	55	12	9,060	18.0
6. part-time operator cash rental landlord	0	1	0	0	729	438	35	16	9,060	48.1
7. full-time cash rental landlord	0	0	0	0	729	638	55	12	9,060	8.4
8. full-time cash rental landlord	0	0	0	0	529	638	55	12	14,060	7.7

Table 3--Probability of Investment in Soil Conservation, The Cornbelt

Tenure and type of lease	Independent variable									Probability of Investment
	share	part	part share	fullop	acreage	value	age	education	net farm income	
	.89	1.07	-1.07	.85	.001	-.0001	-.02	.08	.000005	
1. full-time cash rental landlord	0	0	0	0	303	1,344	55	12	10,650	10.1
2. full-time share rental landlord	1	0	0	0	303	1,344	55	12	10,650	21.4
3. part-time operator cash rental landlord	0	1	0	0	303	1,344	55	12	10,650	24.6
4. part-time operator share rental landlord	1	1	1	0	303	1,344	55	12	10,650	21.4
5. full-time operator	0	0	0	1	303	1,344	55	12	10,650	20.7
6. part-time operator cash rental landlord	0	1	0	0	503	1,144	35	16	10,650	44.7
7. full-time cash rental landlord	0	0	0	0	503	1,344	55	12	10,650	12.1
8. full-time cash rental landlord	0	0	0	0	303	1,344	55	12	15,650	10.3

Row 6, Table 3 shows that in the Cornbelt, the part-time operator cash
rental landlord who owns 200 acres of land more than the average owner, who
owns land worth $200 per acre less than the average value per acre, who
has 16 years of education (compared to the average of 12 years), and who
is 35 years old (compared to the average of 55 years) has a predicted
probability of investment of 44.7 percent. Thus, change from full-time,
55 year old high school educated cash rental landlord status, with owner-
ship of 303 acres worth $1,344 per acre (row 1), to 35 year old college
educated part-time operator cash rental landlord status, with ownership
of 503 acres worth $1,144 per acre (row 6) increases predicted probability
of investment by nearly 35 percentage points.

(c.) The Northern Plains:

In the Northern Plains, neither tenure nor lease type are important predictors
of investment. A sample of 2,055 questionaire responses produced the following
estimate:

(5) ΘX = -2.11 + .04 share + .28 part + .05 partshare + .19 fullop + .00006 acreage
      (.000)   (.433)   (.242)   (.460)   (.198)   (.001)

    + .0004 value - .01 age + .08 education + .000004 net farm income
      (.010)   (.011)   (.000)   (.164)

The dummy coefficients in this equation are quite low, compared to the
corresponding coefficients in equations 2, 3 and 4. They are also statistically
insignificant. Moreover, as Rows 1 through 5 in Table 4 indicate, the predicted
probabilities of investment for the different tenure and lease type categories
show much less variation then do the corresponding probabilities in Row 1
through 5 of Tables 1, 2 and 3.

In contrast to the dummy coefficients, the coefficients for farm acreage
owned, value per acre, age, and education in equation 5 are all significant at
at least the 2.5 percent level.   Row 6 in Table 4 indicates that a full-time cash
rental landlord who is 36 years old, college educated, an owner of 200 acres

Table 4--Probability of Investment in Soil
Conservation, The Northern Plains

Tenure and type of lease	Independent variable									Probability of Investment
	share	part	part share	fullop	acreage	value	age	education	net farm income	
	.04	.28	.05	.19	.00006	.0004	-.01	.08	.000004	
1. full-time cash rental landlord	0	0	0	0	1,271	431	56	12	7,490	18.2
2. full-time share rental landlord	1	0	0	0	1,271	431	56	12	7,490	18.8
3. part-time operator cash rental landlord	0	1	0	0	1,271	431	56	12	7,490	22.7
4. part-time operator share rental landlord	1	1	1	0	1,271	431	56	12	7,490	24.3
5. full-time operator	0	0	0	1	1,271	431	56	12	7,490	21.2
6. full-time cash rental landlord	0	0	0	0	1,471	631	36	16	7,490	29.6
7. full-time cash rental landlord	0	0	0	0	1,471	631	56	12	7,490	19.5
8. full-time cash rental landlord	0	0	0	0	1,271	431	56	12	12,490	18.5

of land more than the average acreage owned, and an owner of land worth $200 per acre more than the average value has a predicted probability of investment of 29.6 percent, substantially higher than the 18.2 percent probability of investment by the "average" full-time cash rental landlord represented in row 1.

Despite the insignificance of the tenure and lease type coefficients in the Northern Plains, the probability of investment by both operators and share rental landlords is nearly the same in this Region as in the Delta and Cornbelt Regions. Consider row 2 in Tables 2, 3, and 4. Despite the relatively large coefficients for "share" in the latter two Regions, the predicted probability of investment by full-time share rental landlords is actually a little greater in the Northern Plains than in the Delta, and only slightly greater in the Cornbelt than in the Northern Plains. Rows 3, 4 and 5 in Tables 2 through 4 show that probabilities of investment by part-time operator cash and share rental landlords and by full-time operators in the Northern Plains are also very close to probabilities of investment by comparable farmland owners in the Delta and Cornbelt. A comparison of row 1 in Tables 1, 2 and 3 with row 1 in Table 4 further indicates that the probability of investment by full-time cash rental landlords is substantially higher in the Northern Plains than in the three other Regions.

Therefore, while the failure of an owner to either operate a fraction of his or her own land, or to use share leases on land rented out is associated with a relatively low probability of investment in the Southern Plains, Delta and Cornbelt Regions, no such association exists in the Northern Plains. Moreover, substitution of share for cash leases on non-operator-owned farmland in the Southern Plains, Delta and Cornbelt will simply raise probabilities of investment in those Regions to the same level that already exists for full-time cash rental landlords in the Northern Plains.

(4.) <u>Past</u> <u>Ownership</u> <u>Trends</u> <u>in</u> <u>the</u> <u>Southern</u> <u>Plains</u>, <u>Delta</u> <u>and</u> <u>Cornbelt</u>:

Regression analyses for the Southern Plains, Delta and Cornbelt

showing that full-time cash rental landlords are less likely to invest

in soil conservation than part-time or full-time owner operators or

share rental landlords are especially significant in view of the nation-

wide trends cited earlier toward increasing nonoperator ownership of

farmland and increasing frequency of cash leasing. Evidence that these

trends have been followed in the three Regions studied is provided by

data from the 1978 Resource Economic Survey (RES) and the 1946 Inman

and Fippin Ownership Survey.

The latter estimated that in 1946, nonoperators in the Southern

Plains accounted for 25 percent of all farmland owners and owned

28 percent of all farmland in that Region. The RES estimated that in

1978, Southern Plains nonoperators accounted for 34 percent of all

farmland owners, and owned 31 percent of all farmland in that Region

(15).

Trends in the Delta and Cornbelt have followed similar paths.

However, before RES and Inman and Fippin data for these Regions can

be compared, the regional boundaries that were initially defined for

purposes of the regression analysis in Section 3 must be redefined.

Recall from Figure 1 that the Delta was initially defined to include

small portions of Tennessee, Kentucky and Missouri in addition to

all of Louisiana, Mississippi and Arkansas. The Delta will now be

redefined to include only the entire areas of the latter three

states.

The Cornbelt was defined in Figure 1 to include southern Michigan, Minnesota and Wisconsin but not eastern Ohio and southern Missouri. In this section, all of Ohio, Michigan, Wisconsin, Minnesota and Missouri as well as Indiana, Illinois and Iowa will be assigned to the Cornbelt.

These redefinitions will apply to RES and Inman and Fippin data on nonoperator ownership as well as to Census of Agriculture data on lease type discussed later in this section. The discussion will also assume that past ownership trends in the redefined Regions are representative of trends in the Delta and Cornbelt Regions that were defined in Figure 1 for purposes of the regression analyses.

Inman and Fippin and RES data show a clear trend toward greater nonoperator ownership in both the Delta and Cornbelt. Inman and Fippin estimated that in 1946, nonopertors accounted for 9 percent of all farmland owners in the Delta and owned 12 percent of all Delta farmland. The RES estimated that by 1978, nonoperators accounted for 30 percent of all farmland owners and owned 30 percent of all Delta farmland (15).

Nonoperators accounted for an estimated 25 percent of all farmland owners in the Cornbelt in 1946 (10), and owned an estimated 31 percent of the land. The 1978 estimates were 37 percent and 34 percent respectively (15).

Leasing practices in the Southern Plains, Delta and Cornbelt have also followed the nationwide trend toward increasing use of cash leasing and declining use of share leasing. The U.S. Census of Agriculture estimated that in 1964, 14 percent of all full-time tenant operators in the Southern Plains used cash leases, while 77 percent used share leases. By 1974, 31 percent used cash leases and 45 percent used share leases.

The Census estimated that in the Delta, the number of full-time tenant operators using cash leases increased from 11 percent to 27 percent, while

the number using share leases declined from 78 percent to 46 percent of all
full-time tenant operators during the period 1964 to 1974. In the Cornbelt,
the number using cash leases increased from 14 percent to 19 percent, while
the number using share leases declined from 78 percent to 63 percent during
the same 10 year period (19). 6/

Equations 2, 3 and 4 may be viewed as reliable estimates of the
relationships existing between tenure and lease type on the one hand, and
probability of investment on the other during the last 30 years, as well as
during the period 1975 to 1977. When applied to the historical data, the
equations suggest that trends toward increasing nonoperator ownership of
farmland and increasing use of cash leasing have had a substantial negative
impact on average landowner contribution to soil conservation investment in
the Southern Plains, Delta and Cornbelt Regions. Two additional issues must
therefore be considered. Will past tenure and leasing trends continue into
the future; and, if so, will any new policies be required to counteract de-
clining average owner contribution to soil conservation investment? These
issues are addressed in Sections 6 and 7.

(5.) Past Ownership Trends in the Northern Plains

Nonoperator ownership and cash leasing have both been increasing in the
Northern Plains, as in the other three Regions. Strohbehn and Wunderlich
estimated that in 1958 nonoperators accounted for 33 percent of all owners
and held 23 percent of all farmland (21). The RES estimated that by 1978,
nonoperators accounted for 44 percent of all owners and held 34 percent of
all farmland.

The Census of Agriculture estimated that in 1964, 8 percent of all full-time
tenant operators in the Northern Plains used cash leases, while 87 percent used
share leases. By 1974, 15 percent of all full-time tenant operators in the
Northern Plains used cash leases and 71 percent used share leases (19).

As equation 5 suggests, however, neither change in tenure nor change in frequency of cash leasing should substantially affect owner contribution to investment in the Northern Plains. Therefore, the need for new policies to counteract the adverse effects of a continuation of past tenure and leasing trends on owner investment appears to be less urgent in the Northern Plains than in the Southern Plains, Delta and Cornbelt. The following discussion is therefore directed primarily at these latter three Regions.

(6.) <u>Future Ownership Trends in the Southern Plains, Delta and Cornbelt</u>:

The discussion in Section 4 suggests that past ownership trends in the Southern Plains, Delta and Cornbelt have negatively affected owner investment in soil conservation. The urgency of the need for policy responses directed at ownership variables depends in part on the likelihood that these past trends will continue.

Prediction of future ownership trends requires an identification of some of the factors responsible for past trends. This paper considers only one factor, rapid farmland price inflation. Between March 1970 and February 1980, the average value per acre of farmland in the United States increased by approximately 245 percent (20). Such inflation has encouraged many nonfarm operators to purchase farmland in anticipation of the substantial capital gains that continuation of inflation will generate.

Nonoperator investors who purchase farmland as an inflation hedge have been important contributors to the trend toward greater use of cash leasing relative to share leasing (13). When farmland prices were relatively stable, most nonoperator landlords were either retired farmers, members of farming families or long-term residents of farm communities. In contrast to these farm-oriented landlords, many nonoperators who have recently purchased farmland as an inflation hedge have no farming background at all (12, 13, 17). Since farm-oriented landlords are generally more willing to share some management responsibility with their tenants than are the newer

nonfarm-oriented nonoperators, they are also more likely to prefer share

leases. Nonfarm-oriented investors who prefer minimal involvement in farm

management are more likely to prefer cash leases because cash rent is deter-

mined independently of the amount the tenant produces (12, 13, 17, 18).

Cash rental contracts enable inexperienced landlords to transfer all decision-

making responsibility to tenants, without exposing themselves to the risk of

loss from tenant mismanagement. Landlords then have the freedom to pursue

nonfarm activities while earning a fixed yet relatively secure cash rent.

Past trends toward increasing ownership of farmland by nonfarm-oriented

nonoperator landlords who prefer cash to share leasing, and the resulting

increase in frequency of cash leasing will likely continue as long as rapid

farmland price inflation continues. If the predicted negative relationships

between nonoperator ownership and cash leasing on the one hand, and investment

in soil conservation on the other continue as well, new policy initiatives

to encourage greater conservation investment may be needed.

(7.) Soil Conservation Policies:

What are the policy implications of the regression analyses presented

in Section 3? Equations 2 through 5 indicate strong relationships between

probability of conservation investment and a number of ownership character-

istics, including tenure, lease type, and age and educational levels. None

of these variables appear amenable to direct policy manipulation, how-

ever. Consider, the impact of increasing educational level. Equations 3, 4

and 5 indicate the effect will be a substantial increase in probability of

investment. Yet such a relationship suggests no clear policy change.

Certainly it does not warrant a policy of, say, encouraging high - school

educated farmland owners to obtain college educations just so that they might invest more frequently in soil conservation.

The strong negative correlation that all four regression equations established between age level and probability of investment, and the substantial impact of tenure and lease type on probability of investment established in equations 2, 3, and 4 also do not suggest clear policy alternatives. Promotion of conservation is clearly inadequate justification by itself for policies to encourage greater ownership of farmland by operators, share rental landlords, or relatively younger farmland owners, or to discourage ownership by nonoperators, cash rental landlords or elderly people.

On the other hand, the relationships estimated between conservation investment and acreage owned, value per acre and net farm income do have important policy implications. As mentioned earlier, these variable are measures of landowner wealth, which in turn establishes ability to finance soil conservation projects. A relevant policy issue is whether financial limitations seriously constrain investment by landowners to the extent that governments should provide additional financial assistance for conservation, either through direct dollar contributions or through tax subsidies.

Under the current policy of the Federal Government, farmland owners and operators can apply for direct federal financing of the costs of qualifying conservation projects. The Agriculture and Consumer Protection Act of 1973, [7] currently administered by the Agricultural Stabilization and Conservation Service (ASCS) of the U.S. Department of Agriculture, provides that applicants may receive funding of up to 90 percent of the cost of each separate project they implement. [8] However, in most cases, the

maximum amount that any one applicant can receive is $3,500 per year,

regardless of how many projects are implemented.[9]

Should these cost share and dollar contribution limitations be raised?
A final answer requires analysis beyond the scope of this paper; however,
the weak relationships estimated in equations 2 through 5 between probability
of investment on the one hand and net farm income, acreage owned and land
value on the other do raise some doubt about the potential impact of such an
increase.

Consider the impact on probability of investment of acreage owned and
value per acre. A comparison of rows 1 and 7 in Tables 1 through 4 indi-
cates that owners having relatively large borrowing leverages, as measured
by total acreage owned multiplied by value per acre, invest only slightly
more frequently than owners having much smaller borrowing leverages. An
increase in farmland owned by the Southern Plains full-time cash rental
landlord of 200 acres, combined with an increase in value per acre of
$200 will increase predicted probability of investment by that owner by
only .2 of a percentage point (see rows 1 and 7, Table 1). The same in-
creases in acreage owned and value per acre will increase probability of
investment by the Northern Plains cash rental landlord by only 1.3 per-
centage points (rows 1 and 7, Table 4).

The sample coefficients for value per acre in the Delta and Cornbelt
are negative. Suppose, therefore, that farmland acreage owned by the
full-time cash rental landlord in these Regions increases by 200 acres,
while value per acre remains constant. Predicted probability of investment
by Delta and Cornbelt cash rental landlords will increase by only .6 of
a percentage point and 2 percentage points, respectively (rows 1 and 7,
Tables 2 and 3).

A comparison of rows 1 and 8 in Tables 1 through 4 suggests that farmland owners earning relatively large net farm incomes also invest only slightly more frequently than owners earning smaller net farm incomes. A $5,000 increase in net farm income increases predicted probability of investment by less than a percentage point in the Southern Plains, Cornbelt and Northern Plains Regions, and actually reduces predicted probability of investment in the Delta, although by only .1 of a percentage point.10/

These results suggest that insufficient income and borrowing leverage may not be significant constraints on the ability or willingness of farmland owners to invest in soil conservation practices. Whether increases in ceilings on federal cost share or dollar contributions for the financing of these projects will significantly increase the rate of owner investment therefore appears doubtful.

However, while the regession results provide little evidence to support an increase in direct governmental financing of conservation investment, the strong relationships estimated between probability of investment and choice of leasing contract in equations 2, 3 and 4 provide some support for change in an existing federal income tax policy that indirectly subsidizes conservation investment. The subsidy is provided by Section 175 (a) of the Internal Revenue Code, which allows qualifying farmland owners and operators to treat soil conservation expenditures as currently deductible expenses rather than as capital expenses. Section 175(a) states that:

> "a taxpaper engaged in the business of farming may treat expenditures...
> for the purpose of soil or water conservation in respect to land used
> in farming, or for the prevention of erosion of land used in farming
> as expenses which are not chargeable to capital account. The
> expenditures so treated shall be allowed as a deduction..."

Section 175(b) limits the amount deductible to "25 percent of the gross income derived from farming during the taxable year."

Under current Treasury regulations, full-time share rental landlords, but not full-time cash rental landlords qualify as taxpayers "engaged in the business of farming..." for purposes of Section 175(a).[11] Therefore, share rental landlords can deduct the entire amount of their expenditures for soil conservation in the same year the expenditures are made, subject only to the 25 percent limitation of Section 175(b). Cash rental landlords must treat all such expenditures as capital expenses, only a fraction of which can be deducted in the year the investment is made. The balance must be deducted over a period of years according to an appropriate depreciation schedule. Since taxpayers can generally attain lower taxable incomes and thus higher after-tax incomes by deducting the entire amount of investment expenditures from gross income, rather than by treating investments as depreciable assets, the potential "after tax" cost of a conservation investment will be lower for the share rental landlord than for the comparable cash rental landlord. Ceteris parabus, the former has a greater incentive to invest in conservation than the latter.

This conclusion suggests a change in policy. To encourage greater conservation investment by cash rental landlords, IRS regulations could be amended to extend eligibility for current deductibility of conservation expenses under Section 175(a) to all landlords regardless of lease type.[12]

(8.) Conclusion:

During the three year period 1975-1977, farmland owners in the Southern Plains, Delta and Cornbelt Regions who operated at least part of their own land or used share leases on land they rented out were much more likely to have invested in conservation than were full-time nonoperator landlords who used only cash leases. No such distinction appears to have existed, however, between operator and nonoperator landlords, or between share rental landlords and cash rental landlords in the Northern Plains Region.

In all four Regions, probability of owner investment in conservation was positively correlated with educational levels, and, to a lesser extent, total acreage owned, and negatively correlated with age. A weak positive correlation existed between probability of investment and value per acre of farmland held by Southern Plains and Northern Plain owners, while a weak negative correlation existed among Delta and Cornbelt owners. Probability of investment and net farm income were positively correlated in the Southern Plains, Cornbelt and Northern Plains and negatively correlated in the Delta. In all cases however, the degree of correlation was quite small.

The estimated regression equations provide little support for policies to increase direct governmental financing of soil conservation investment. However, given the lower predicted probability of investment by nonoperator cash rental landlords relative to nonoperator share rental landlords, it can be argued that the former should no longer be denied eligibility under I.R.C. Section 175 for current deductibility of investment expenditures.

The urgency of the need for new policy initiatives depends in part on the likelihood that past trends toward greater nonoperator ownership and greater use of cash leasing will continue, especially in the three Regions where the estimated negative impact of nonfarm operation and cash leasing on probability of investment in soil conservation is strong. The role of tenant farm operators must also be examined. This paper has considered only landowner contribution to investment. It is possible that even if owner contribution declines in the future, total investment may remain the same or even increase because of increasing tenant contribution. Thus, until the causes of current ownership trends, and the prospects for future ownership trends and trends in tenant characteristics and investment activity are better known, new policies directed at farmland owners may be unnecessary or premature.

FOOTNOTES

2/ The Census of Agriculture provides data for three types of share tenants –
share-cash, crop-share, and livestock-share. The Census definitions
are as follows:

    (1) Share-cash tenants pay part of the rent in cash and part in
        a share of the crop and/or of the livestock and livestock
        products. In some cases where a tenant operates more than
        one tract of land, he may have paid cash rent only on one
        tract and have had some share arrangements on other tracts.

    (2) Crop-share tenants pay a share of the crop but not of the
        livestock products.

    (3) Livestock-share tenants pay a share of the livestock or
        livestock products. They may or not also pay a share of
        the crops.

(1974 Census of Agriculture, Vol. II, Ch. 3, p. 3).

In this paper, "share rental" tenants and landlords include all
operators and owners who report use of some form of share lease to
calculate rents on any land they operate or rent out. "Cash rental"
tenants and landlords include operators and owners who use only cash
leases on land they operate or rent out.

While the lease type data cited in this paper refer only to rental
arrangements on land operated by full-time tenants, studies by Reinsel
and Johnson (17) suggest that cash leasing has been increasing relative
to share leasing on rental land operated by part-owner farmers as well.
Recent Census data on type of lease employed by part-owners is not
available, however.

3/ Tenure refers to the degree if any to which owners operate their own
land. Lease type refers to the choice of either share or cash rental
contracts on land rented out.

4/   For purposes of the regression analyses, each respondent was assigned
     a net income equal to the midpoint value of the applicable category,
     assuming the category was not open-ended. Respondents who fell within
     the "more than--$10,000 loss" category were assigned a net loss of
     $11,500. Respondents who fell within the "over $50,000" category,
     were assigned a net income of $55,500.

5/   Under fairly general conditions, maximum likelihood estimates of the
     parameters $\Theta_0, \ldots, \Theta_9$ are consistent. Moreover, both the parameter
     estimates and their variances are asymptotically normally distributed
     (14). Therefore, given the large size of the samples analyzed in this
     paper, the assumption that the estimated logit coefficients are both
     unbiased and normally distributed appears warranted, indicating the
     standard normal distribution can be used for hypothesis testing.

6/   Data on leasing trends among part-owner operators is not available. As
     mentioned in footnote 1, studies by Reinsel and Johnson (16) suggest that
     the frequency of cash leasing relative to share leasing among part owners
     has been increasing.

7/   16 U.S.C. 1501, et. seq. (Aug. 10, 1973).

8/   45 Fed. Reg. 49520, 49525 (1980) (to be codified in 7 CFR § 701.13(b)).

9/   45 Fed. Reg. 49520, 49527 (1980) (to be codified in 7 CFR § 701.23).

10/ The lack of statistical significance of the net farm income coefficients
     in equations (3), (4) and (5) may be partly attributable to collinearity
     between net farm income and acreage owned (the sample partial correlation
     coefficient between net farm income and acreage owned is approximately
     .22 in the Southern Plains, .42 in the Delta, .27 in the Cornbelt, and
     .15 in the Northern Plains). However, collinearity does not appear to
     be the major factor responsible for the low values of the coefficients.

This can be demonstrated through reestimation of the four regression equations, after removal of the "acreage" variable. The new regression equations for the Southern Plains, Delta, Cornbelt and Northern Plains Regions are:

2(a.) ΘX = -1.17 + .71 share + 1.33 part - .40 partshare + 1.27
        (.018) (.016)   (.000)   (.218)   (.000)

        fullop + .00006 value - .03 age + .03 education +
              (.201)   (.000)   (.062)

        .000008 net farm income
        (.017)

3(a.) ΘX = -3.33 + .97 share = + 1.60 part - .95 partshare + .99
        (.000) (.032)   (.003)   (.085)   (.014)

        fullop - .0001 value - .02 age + .14 education + .000005 net
              (.302)   (.017)   (.000)   (.144)

        farm income

4(a.) ΘX = -2.42 + .96 share + 1.15 part - 1.0 partshare + .98 fullop
        (.000) (.000)   (.001)   (.007)   (.000)

        - .0002 value - .02 age + .10 education + .00001 net farm income
        (.002)   (.000)   (.000)   (.000)

5(a.) ΘX = -2.21 + .004 share + .44 part - .05 partshare + .23 fullop
        (.000)   (.495)   (.129)   (.460)   (.147)

        + .0003 value - .01 age + .09 education + .000006 net farm income
        (.046)   (.028)   (.000)   (.066)

These equations show that after removal of "acreage", the coefficient for "net farm income" becomes significant at the 1 percent level in the Cornbelt, at the 2.5 percent level in the Southern Plains, and at the 10 percent level in the Northern Plains. The coefficient changes from negative to positive in the Delta, while remaining statistically insignificant.

Despite these changes, increases in the value of the coefficients
are small. The new coefficients in equations 2(a) through 5(a) remain
quite low relative to the coefficients for age and education as well as
most of the dummy coefficients.

11/ Treasury Regulation 1.175-3, T.D. 6649 (1963) states that "a taxpayer
who receives a fixed rental (without reference to production) is engaged
in the business of farming only if he participates to a material extent
in the operation or management of the farm." This definition excludes
the full-time cash rental landlord, defined in this paper as a farmland
owner who claims to operate no farmland on his own.

12/ Under current ASCS regulations, cash rental landlords as well as share
rental landlords are eligible to apply for cost sharing assistance under
the Agriculture and Consumer Protection Act. 7 C.F.R. § 701.7 (1980).

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